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how to identify damage by major oak borers in the eastern united states

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Wood borers attack all commercial species of hardwood trees in the eastern United States. Together, wood-boring and cambium-mining insects cause a greater loss of high-grade hardwood than all other damaging agents combined. In oak timber in the eastern United States, borer mining and tunneling produce the major defects that reduce the value of timber managed for lumber and veneer. Lumber degrade studies from five of these states showed that oak borer losses average \$25 per thousand board feet of oak produced, with an annual loss estimated as high as 120 million dollars in the eastern United States (from Louisiana, Arkansas, Missouri, and Iowa, east to the Atlantic coast).

The damage caused by oak borers is



*Figure 1.
First year attack
by red oak borer.*

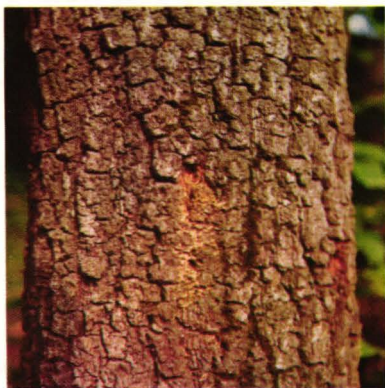


*Figure 2.
Second year
attack by
red oak borer.*



Figure 3. Frass of red oak borer (right circle) and carpenterworm (left circle) at base of tree.

usually not recognized in standing trees. It becomes obvious only after the trees are sawn into lumber or sliced into veneer because most borer activity is confined to wood under the bark. Only the adult borers can be found outside the host tree. Each species of oak borer produces characteristic tree surface indicators, such as entrance and exit holes, frass and stains, which aid in the detection and identification of a particular species.

Red Oak Borer *Enaphalodes rufulus* (Haldeman)

The favored host oaks of the red oak borer are red, black, scarlet, white, willow, and Nuttall. It will breed in most species of oak in this area.

The pest has a 2-year life cycle. Eggs are laid in July and August on the bark of trees 2 inches or more in diameter. The young larvae enter the tree by boring a pin-size hole. During the first fall and winter, the only surface indications of larval activity are the entrance holes and very fine extruded frass (Figure 1). The larvae resume boring in April, producing new frass that can be seen around the enlarged entrance hole. In May, the bark around the entrance hole becomes wet and stained. This ooze

becomes foamy and ferments, attracting ants, flies, bees, and butterflies. By July, the attack site becomes dry; and granular frass can be found around the entrance hole (Figure 2). The larvae bore into the sapwood and produce more frass. From August to November, the frass piles up at the base of the tree, providing another indication of borer attack (Figure 3). Boring is resumed in April of the second year, and a sure sign of successful attack is the appearance of frass and excelsior-like fibers around and immediately below the entrance hole. The adults leave the tree through 1¼-inch × ½-inch oval holes cut through the outer bark.

In lumber, red oak borer tunnels are different sizes and shapes (Figure 4). The tunnels are usually free of granular frass but contain some excelsior type frass. There is very little stain associated with tunnels.

Carpenterworm *Prionoxystus robiniae* (Peck) and *P. macmurtrei* (Guerin-Meneville)

These carpenterworms prefer red, black, scarlet, and Nuttall oak as hosts in the South and East.

The life cycle of these insects lasts 1

Figure 4. Lumber defect caused by red oak borer.

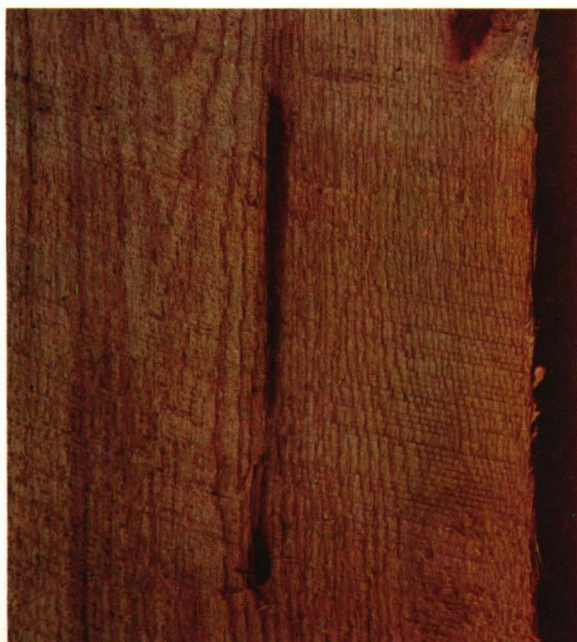


Figure 5. "Sap-wet" entrance hole of carpenterworm.



year in the South and up to 4 years in the North. The eggs are laid in late spring to early summer, near wounds, scars, and crevices in the bark. The young larvae penetrate the sapwood during the fall of the first year. They spend the remaining 6 months to 4 years tunneling in sound wood. The larval tunnel and entrance hole are free of frass, but the clean "sap-wet" appearance of the entrance hole and coarse-webbed frass at the base of the tree indicate a successful attack (Figures 3, 5). Moths emerge near the larval entrance hole. The empty pupal case often projects halfway



*Figure 6.
Stained lumber
defect caused by
carpenterworm.*



Figure 7. Powdery frass of oak timberworm indicates successful attack.



Figure 8. Lumber defect caused by oak timberworm.

out of the exit hole.

Damage to lumber consists of holes $\frac{1}{2}$ inch to $1\frac{1}{2}$ inches in diameter and up to 10 inches long. These holes are characteristically surrounded by a dark stain (Figure 6).

Oak Timberworm *Arrhenodes minutus* (Drury)

This insect can be found in small trees but is most damaging in trees larger than 5.5 inches dbh. Preferred hosts are mature oaks of both the red and white oak groups. The life cycle is usually completed in 2 or 3 years.

Eggs are laid in late spring and early

summer. The female chews a cylindrical hole into exposed sapwood and lays a single egg. Females often lay eggs in wounds made by other wood borers and commonly use red oak borer tunnels as sites for egg laying. The larvae hatch in a few days and bore into sound wood, extending the tunnels in all directions. Each larva bores almost through the tree to a point just under the bark and then "U" turns back across the grain to the point of origin. Pupation takes place in the gallery. Adults emerge through the enlarged hole at the egg site. Successful attacks are best identified by white, powdery frass found at the egg site (Figure 7).

Winding tunnels, from 1/100 inch up to 1/8 inch in diameter, characterize the damage in lumber (Figure 8).

White Oak Borer *Goes tigrinus* (DeGreer)

This insect is a pest of white, overcup, burr and post oak. It usually attacks wood less than 6 inches in diameter and attacks limbs of trees as well as trunks. The pest has a 4- to 5-year life cycle.

Eggs are laid singly in a small niche chewed through the bark. The larvae hatch and bore directly into the sapwood, later extending their tunnels up and into the heartwood. Frass tubes and particles at the egg site are sure signs of active attacks. Because larvae feed for several years, attack sites are repeatedly overgrown (Figure 9). The larvae pupate in a portion of the

Figure 9.

Successful attack by the white oak borer.





Figure 10. Characteristic lumber defect caused by white oak borer.

heartwood gallery blocked off by a frass plug. The adult emerges from the trees and leaves a 1/2-inch round exit hole.

Damage in lumber consists of tunnels 1/2-inch in diameter and 5 to 10 inches long. The characteristic stains are up to 3 feet long (pore streaks). Both are found in one or two annual rings (Figure 10).

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